

THE CLAIMS

Please **CANCEL** claims 9 and 13; and **AMEND** claims 1-8, 10-12, 14-17, as follows. A copy of all pending claims and a status of the claims is provided below.

1. (Currently amended) A universal battery charger for charging batteries with different number of cells connected in series, comprising:

a power supply circuit that produces a DC output voltage, the power supply circuit including a first switch circuit to control a level of the DC output voltage that produces a predetermined number of voltages different in level for applying selected one of the predetermined number of voltages to a battery, the predetermined number of voltages including a highest voltage and a lowest voltage;

~~a battery voltage detecting circuit that detects a voltage level across the battery before charging the battery;~~

a second switch that is connected between the power supply circuit and the battery and is turned ON to allow charging of the battery and OFF to interrupt the power supply circuit from the battery; ~~and~~

an output voltage detecting circuit that detects a voltage level of the DC output voltage of the power supply circuit;

a battery voltage detecting circuit that detects a voltage level across the battery;

an output voltage setting circuit that produces a predetermined number of voltages different in level;

~~a control device that always selects one of the predetermined number of voltages with any being selectable depending upon the detected voltage level across the battery before any charging of the battery and then controls the switch to turn ON so that a rush current does not flow in the battery at the start of charging~~

a control unit that receives a detected signal from the battery voltage detecting circuit and sends a control signal to the output voltage setting circuit to select one of the

predetermined number of voltages as a reference voltage; and

an output voltage control circuit that compares the reference voltage with the voltage level detected by the output voltage detecting circuit to produce an output signal corresponding to a difference between the reference voltage and the detected voltage level, the output signal of the output voltage control circuit being applied to the first switch to control the level of the DC output voltage of the power supply circuit;

wherein the control unit includes means for controlling the second switch to turn ON and OFF, and means for producing the control signal applied to the output voltage setting circuit to select a voltage level which is close to the detected voltage level across the battery when the second switch is turned OFF and the control unit detects that the battery is connected to the battery charger.

2. (Currently amended) The universal battery charger according to claim 1, wherein the output voltage control circuit device controls the first switch ~~power supply circuit~~ to produce a voltage equal to or close to the reference voltage produced detected by the output battery voltage setting detecting circuit ~~and further controls the switch to turn on.~~

3. (Currently amended) The universal battery charger according to claim 2, wherein the control unit device controls the second switch to turn on after expiration of a predetermined period of time from a time when the selected voltage level is applied to the output voltage control circuit ~~voltage equal to or close to the voltage detected by the battery voltage detecting circuit is produced by the power supply circuit.~~

4. (Currently amended) The universal battery charger according to claim 1 3, wherein the control unit selects a voltage level which is higher than the voltage detected by the battery voltage detecting circuit among the predetermined number of voltages ~~when the second switch is turned ON voltage close to the voltage detected by the battery~~

~~voltage detecting circuit is a voltage above and closest to the voltage detected by the battery voltage detecting circuit among the predetermined number of voltages.~~

5. (Currently amended) The universal battery charger according to claim 1 3, wherein the control unit selects a voltage level which is ~~control device further controls the power supply circuit to produce the highest among the predetermined number of voltages~~ voltage after the second switch is turned on.

6. (Currently amended) The universal battery charger according to claim 1 2, ~~further comprising a battery connection detecting device that detects that the battery is connected for being charged, wherein~~ the control unit checks whether the battery is connected to the battery charger from ~~when the battery connection detecting device detects that the battery is connected, the battery voltage detecting circuit detects a voltage across the battery and the control device controls the power supply circuit to produce the voltage equal to or close to the voltage detected by the battery voltage detecting circuit, and thereafter controls the switch to turn on.~~

7. (Currently amended) The universal battery charger according to claim 1 6, wherein the control unit selects a voltage level which is lowest among the predetermined number of voltages when the second switch is turned OFF and the batter is not connected to the battery charger ~~when the battery connection detecting device detects that the battery is not connected, the control device controls the power supply circuit to produce the lowest voltage.~~

8. (Currently amended) The universal battery charger according to claim 1 2, wherein the control unit controls the second switch to turn on when a difference between the voltage detected by the battery voltage detecting circuit and the voltage produced by

the power supply circuit falls within a predetermined range, ~~the control device controls the switch to turn on.~~

9. (Cancelled)

10.(Currently amended) The universal battery charger according to claim 8 9, wherein the control unit device selects a voltage level which is further controls the power supply circuit to produce the highest among the predetermined number of voltages ~~voltage~~ after the second switch is turned on.

11. (Currently amended) The universal battery charger according to claim 1, wherein the second switch is directly connected to the battery.

12. (Currently amended) The universal battery charger according to claim 1, wherein the second switch is directly connected to the power supply circuit.

13. (Cancelled)

14. (Currently amended) A The universal battery charger ~~for charging batteries having different numbers of cells connected in series, comprising:~~

~~a power supply that produces more than two different predetermined number of voltages each different in level for applying a selected one of the predetermined number of voltages to a battery prior to any charging with any of the predetermined number of voltages being selectable based on a detected voltage level across the battery, the predetermined number of voltages including a highest voltage and a lowest voltage;~~

~~a switch connected between the power supply and the battery and is turned ON to connected the selected one of the predetermined number of voltage to the battery and OFF to interrupt the power supply from the battery; and~~

~~a controller that controls the power supply to produce a voltage to be applied to the battery and also controls the switch after application of a signal to control the power supply to prevent a rush current flowing in the battery when the voltage applied to the battery is switched from one level to another level~~
according to claim 1, wherein the output voltage setting circuit produces more than two different predetermined number of voltages each different in level.

15. (Currently amended) A method of charging a battery using a universal battery charger comprising:

a power supply circuit that produces a DC output voltage which includes a first switch circuit to control a level of the DC output voltage ~~a predetermined number of voltages having a first level, a second level which is lower than the first level and a third level which is lower than the second level, and a selected one of the predetermined number of voltages being applied to the battery;~~

~~a battery voltage detecting circuit that detects a voltage level across the battery before charging the battery;~~

a second switch that is connected between the power supply circuit and a the battery and is turned ON to allow the charging of the battery and OFF to interrupt the power supply circuit from the battery; ~~and~~

an output voltage detecting circuit that detects a voltage level of the DC output voltage;

a battery voltage detecting circuit that detects a voltage level across the battery;

an output voltage setting circuit that produces a predetermined number of reference voltages different in level, the reference voltages including a first level, a second level lower than the first level and a third level lower than the second level;

a control unit that receives a detected signal from the battery voltage detecting circuit and sends a control signal to the output voltage setting circuit to select one of the reference voltages; and

an output voltage control circuit that compares the selected reference voltage with the voltage level detected by the output voltage detecting circuit to produce an output signal to control the level of the DC output voltage of the power supply circuit;

~~a control device that always selects one of the predetermined number of voltages to be applied to the battery prior to any charging with any of the predetermined number of voltages being selectable based on the detected voltage level across the battery;~~

wherein the method comprises:

first step of selecting a voltage having the third level produced by the output voltage setting circuit when the control unit detects that the second switch is rendered OFF before the battery is connected;

~~second step of detecting selecting a voltage from the first, second and third levels to be applied to the battery after the battery is connected, depending upon the voltage across the battery detected by the battery voltage detecting circuit; and~~

third step of selecting one of the first, second and third voltage levels which is higher than the detected battery voltage; and a voltage having the first level to be applied to the battery after the second step.

fourth step of applying the selected voltage level to the output voltage control circuit to control the level of the DC output voltage of the power supply circuit; and

fifth step of controlling the second switch to turn ON.

16. (Currently amended) A The method of charging a battery as defined in according to claim 15, wherein the fifth third step is performed when a predetermined period of time has elapsed after the fourth second step.

17. (Currently amended) A The method of charging a battery as defined in according to claim 15, wherein the fifth third step is performed when a difference between the voltage detected by the battery voltage detecting circuit and the voltage

Serial No.: 10/724,205

--8--

produced by the power supply circuit falls within a predetermined range ~~has dropped to a~~
~~level close to the detected battery voltage.~~